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# Sentinel-1 and GPS measurements of the 3-component time-dependent crustal deformation in Southern California

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We calculate the three components of the interseismic surface velocity field in Southern California from a combination of Sentinel-1 InSAR data collected between 2014-2018 and continuous GPS measurements. We use overlapping InSAR tracks with two different look geometries (descending tracks 71, 173, and 144, and ascending tracks 64 and 166) to obtain the 3 orthogonal components of surface motion. The local azimuths of the horizontal velocity vectors obtained from the continuous GPS network provide an additional constraint that is necessary because of the under-determined nature of the problem. We estimate both secular velocities and displacement time series. The latter are obtained by combining InSAR time series from different lines of sight with time-dependent azimuths computed using continuous GPS time series at every InSAR epoch. We use the CANDIS method [Tymofyeyeva and Fialko, 2015], a technique based on iterative common scene stacking, to correct the InSAR data for tropospheric and ionospheric artifacts before calculating secular velocities and time series. This correction makes it possible to isolate low-amplitude deformation signals in our study region. The obtained horizontal (East and North) components of secular velocity exhibit long-wavelength patterns consistent with strain accumulation on major faults of the Pacific-North America plate boundary. The vertical component of velocity reveals a number of localized uplift and subsidence anomalies, most likely related to hydrologic effects and anthropogenic activity. Specifically, in the Los Angeles basin we observe localized uplift of about 10-15mm/yr near Anaheim, Long Beach, and Redondo Beach, as well as areas of rapid subsidence near Irvine and Santa Monica, which are likely caused by the injection of water in the oil fields, and the pumping and recharge cycles of the aquifers in the basin.